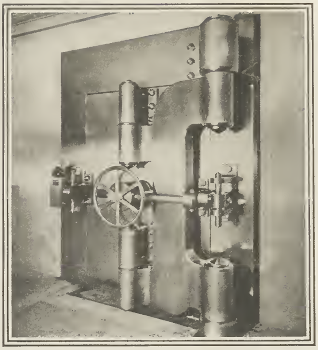
Protecting Our Great Banks

Armor of Concrete and Steel that Aims to Foil the Scientific Cracksman

By Edward H. Smith

ON A memorable Monday morning in 1878—October 28, to be precise—the cashier of the old Manhattan Savings Institution turned his key in the lock of the street door, walked nonchalantly into the banking room and fainted. Men will do stranger things in the face of miracles, and one had been wrought here. The door of the great iron vault gaped open, torn and twisted on its hinges, as though a Titan had wrenched it with the weight of mountains and the power of tides. On the floor was a litter of papers, account books, coins, pieces of shattered iron and ends of broken tools. From the interior of the huge metal box, long considered beyond the strength and ingenuity of men, was missing a total of $2,747,700 in cash and bonds. The greatest bank robbery in our history had been committed between Saturday night and that sickly dawn.

The cashier revived, summoned the other officers in haste, closed the doors and put up a sign relating that the bank had been forced to suspend because of robbery. Policemen came in droves; crowds gathered and tried to storm the entrance; the news spread through the city and across the country; runs on other banks began and were checked with difficulty. The corner of Broadway and Bleecker Street, where the bank stood, was obstructed for many days with crowds of curious people who had come to see where this astounding thing had taken place. The doings of a small gang of cracksmen became a piece of history.



Huge rectangular plug door closed, showing the massive hinges and the exterior mechanism

To this burglary, just forty-five years ago, is to be traced the beginning of modern developments in the protection of our great banks against criminal attack, so it may be worth while to glance at some of the facts concerning it.

A gang of notorious professional bank burglars, headed by the famous Jimmie Hope, had laid plans for the attack on the Manhattan Savings Institution and consumed all of three years in working out their scheme. They had eventually corrupted one Michael Shevelin, the bank watchman, gained entrance to the place with his collusion and worked on the vault door with wedges, powerful jackscrews and explosives, through the nights of Saturday and Sunday, finally reaching the bonds and cash at about 3:30 o'clock on Monday morning. Their loot consisted of $2,506,700 in registered bonds, $73,000 in coupon bonds and a fortune in cash. To save the bank from disaster and foil the robbers, the Congress and the State Legislature passed acts cancelling the stolen registered bonds and causing fresh securities to be engraved and issued in their stead. To such lengths the nation had to go to protect its finances against a few bold and clever men.

It must not be assumed that such a burglarious raid as that on the Manhattan Savings Institution had happened without precedent or that the banks had not done what they could to prepare for such attacks. The burglary of large banks was an old story in 1878, and great quantities of inventive energy and of bank money had then already been expended in the quest of some method of vault construction that could be relied upon. It is interesting to note some of the ideas then applied.

The vault of the old National Park Bank, when it was finally dismantled some years ago, to make room for a modern substitute, was found to have been built of solid slabs of granite, closely fitted together. The edges of each such slab had been incised with a series of hemispherical depressions, which fitted precisely to similar scoopings from the adjoining granite blocks, thus forming globular holes, five or six inches in diameter. Into each of these holes a cannon ball had been placed, so that if a burglar tried to enter the vault by digging at the joints of the stones, he would encounter the loose cast-iron balls.

Another vault, of a slightly later period, had been formed, inside a construction of solid masonry, of two plates of cast iron, each about one and one-half inches thick. The inner face of each of these plates had similarly been cut with innumerable hemispherical depressions which fitted against other such cuttings in the opposing plate. Into the spherical holes thus formed had been placed large numbers of chilled cast-iron balls, like large ball bearings. The notion was that these loose balls would deflect the drill of any burglar attempting to make his way into the vault. It must be remembered that nitro-glycerine was then unknown and that the burglar had to drill holes to get at the tumblers of the locks or to blow in the gunpowder which was then his only explosive agent.

But all such precautions were not of much avail, for the reason that the better bank burglars of the day understood how to attack the strongest vault doors then in existence. Invention had provided nothing better than heavy, close-fitting doors of cast iron, chilled and later case hardened, but iron doors, after all. We shall have a word to say about the evolution of the vault door. For the present it is enough to observe how burglars, without such weapons as they now possess, ripped their way through the no doubt formidable defenses of the old banks.

Another New York City feat of the same Jimmie Hope will illuminate the matter. In the fall of 1868, Hope rented a basement under the rooms of the Ocean National Bank at the corner of Fulton and Greenwich Streets and opened a carpet business. In front was his show room; in the rear his work room. To divide these and keep customers and passersby from intruding on his privacy, he had a partition erected, dividing the two parts of his establishment. In reality, this ceiling-high screen was put in place to mask his operations against the bank, whose vault he had carefully studied.

On the night of June 27, 1869, nine years before his greater feat at the Manhattan bank, Hope and several assistants, including the famous old robbers, Ned Lyons, Mark Shinburn and George Bliss, reached the banking rooms by means of a hole they had been slowly cutting through the ceiling of their carpet store and the floor of the bank. They went to work on the door of the vault with wedges. First a fine wedge, no thicker than the blade of a knife, was hammered into the crack of the door near the lock. A slightly thicker wedge was next pounded into place with sledges, and then a still heavier tool took its place. Gradually the burglars worked their way up to wedges two or more inches thick at the base. These were forced home with big jackscrews, which got their purchase from heavy iron bands or cables which had been passed around the vault or secured to its back by heavy hooks. Gradually the jacks were turned until the thick wedges forced their way in and pried the door from its iron jam. The bolts were now forced back and the work was done. Explosives and heavy crowbars were then used on the inner iron door. This robbery totaled $1,200,000, of which, fortunately, the larger part was in non-negotiable bonds.

As a consequence of this mode of attack, the construction of doors came to be the matter of chief concern with the vault builder. The first heavy doors in use had been straight edged, like the end of a square-sawed board. Then, in order to get a door that would close more tightly, came the bevelled or sloping edge, the inner face of the door being narrower than the outer. But the wedges of the burglars soon put this pleasant scheme to rout. Then came the stepped edge which is still in use on all ordinary office safes. The steps were designed to stop the wedges from penetrating beyond an inch or two. Wedges backed by powder formed the burglar's answer to this scheme. Then came the tongue-and-groove edge, which did good service until nitro-glycerine came along. The grooves now proved to be a happy circumstance for the cracksman. His liquid explosive lodged in them and he got wonderful results from a minimum of "soup." Faced with this peril, the vault builders went back to a battleship or armor-plate door, which was soon found worthless.

To day, in the best modern vaults, only one type of door is employed, the so-called plug door, shaped exactly like the cork of a medicine bottle, with smooth edges, no steps or grooves and slightly smaller in diameter inside than out. Such doors vary in thickness from two to five feet. They may be either round or rectangular and they weigh as high as a hundred tons! Laboratory experiments have shown that the plug door gives the maximum of resistance to nitro-glycerine. If a quantity of this explosive is forced into the crack at the door jam and detonated, the main force of the explosive will spurt into the vault and out into the room, because the edge of the door is perfectly smooth, giving the explosive no purchase.

The construction of such doors is one of the marvels of modern vault engineering. Entirely aside from its complicated multiple time-locks, its numerous powerful bolts, its intricate inner locking devices and its other mechanical intricacies, such a door is a first-class piece of engineering. It seems to the eye to be a solid piece, yet it consists of many layers; it is a composite in more than one sense. The layers, to mention only some of them, are ordinary strain resisting steel; reinforced concrete, used against fire; heat resisting metal, to delay burglars operating with the cutter-burner torch; tool resisting metals; at least one and often two layers containing the wires and foils of electric burglar alarm systems, and so on.

A 30-inch thick block of steelcrete (concrete and steel) after a laboratory attack lasting only a few minutes, made with modern tools

Such tremendous doors are in use by some of the Federal Reserve Banks, notably in Philadelphia and Cleveland, by J. P. Morgan and Company and others. The Morgan door weighs about 50 tons and that of the Cleveland Federal Reserve Bank, the thickest if not the largest ever built, is said by its makers to achieve a total weight of almost two hundred thousand pounds.

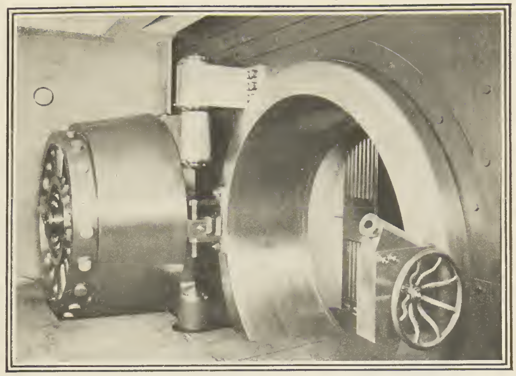
But when we have glanced at these surprising facts and figures, the real wonder of the modern bank vault has only been hinted. It is a maxim with the builders of these strong rooms that a vault is, like a chain, as dependable as its weakest link or part. Thus the floor and sides of the vault must be capable of offering the same amount of resistance as these tremendous doors.

They must be designed to foil any possible or conceivable method of assault. In addition, they must be constructed to resist fire and the tremendous heat likely to be developed when a great building comes into conflagration. In consideration of this risk, the roofs or tops of the big vaults of today must be even stronger than the floor, sides and front or door, for the roof must be additionally reinforced against the impact of falling bodies from above, in case of the collapse of a building through fire or earthquake.

What kind of engineering is required for the achievement of such prodigious strengths may be guessed when the dimensions of the really big bank vaults are understood. For instance; in the new Federal Reserve Bank in New York there are three such vaults, one on top of the other. Each vault measures about 125 feet in depth and about 55 feet in average width. The bottom of the nethermost room rests on bedrock and the walls of the vaults are in part under the waters of the harbor. The main door of each of these vaults weighs about 90 tons and each of the three rooms has a second or emergency door, used for ventilation during business hours. The weight of each main door with its vestibules is in excess of 300 tons and the materials composing them are those already listed, tool resisting metals, steel, acetylene torch resisting metals, reinforced concrete, cables, alarm wires and the like. The vault doors of this bank are not of the plug type, another and unique design having been employed to suit the needs of the building in which the vaults were placed.

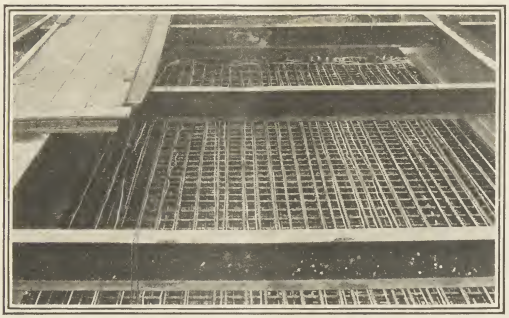
In describing the structure of the walls, floor and roofs of our great vaults, it is to be remembered that no standard has yet been arrived at, that a number of engineers entertain conflicting ideas about certain details of construction and that experiment is constantly being carried forward. Again, the chief difficulty in arriving at a perfected type of vault, and one that is not likely to be overcome in the future, is the matter of the constant development of tools useful in attacks on such constructions. Some months ago, in articles devoted to the struggle between the burglar and the maker of safes for small banks, I accentuated the fact that a race, like that between the gun maker and the builder of battleship armor, is in progress and has been for at least two generations. The same thing is true of the great bank vault. There has not been a successful burglary committed upon the vault of any great metropolitan bank in this country since 1878. Nevertheless, industry and the arts have gone ahead and perfected a number of tools which might at any time be employed by burglars of sufficient skill and daring to seize the opportunity. To this class belong the electric arc, the electric and pneumatic chisel, the electric drill and the oxy-acetylene torch in its latest development.

This last named tool is of especial peril and interest. I have previously written of its effectiveness against the safes and vaults employed in rural or suburban banks and the defeats met by manufacturers of strong boxes for this clientele. It now appears that the cutter-burner tool, as it is preferably called by vault engineers, is a decided menace even to the great banks and their ponderous equipment, so that much reconstruction and endless experiments are in progress. To date nothing has been found that can be called a genuinely effective resistant.



Fifty-ton plug door of the vault in one of our great private banking houses. The floor is removable. The door is 36 inches thick

The effort to find metals which would foil the withering flame of the torch is not without its note of romance. When the oxy-acetylene cutter-burner was first employed there was a great scamper after heat resisting metals and a number of compositions were produced which withstood the fiery tongue of the torch fairly well. (I mean to say compositions sufficiently low in cost to be commercially useful.) When these discoveries were made the vault and safe building world breathed easier again, but only for a short space. Then the inventors of the torch discovered that they could add immensely to the cutting and fusing power of their tool by using the so-called fluxing rod. Their purpose was, of course, to extend the industrial use of the torch, but what they turned out proved to be a most formidable burglarious tool.



Ready to pour a great vault for a Federal Reserve Bank. Note the reinforcement rods for concrete interlaced with the cables for burglar alarm system

The fluxing rod is a stick of soft steel. When the flame of the torch is applied to any metal, for the purpose of cutting and melting, the end of the steel rod is placed at the tip of the flame and against the metal to be cut. The very rapid oxidation of the soft steel rod raises the normal temperatures produced by the torch to enormous levels and the additional excoriating effect of the iron oxide enables the operator of this device to cut and burn his way with tremendous rapidity through any material or combination of materials now known to practical use. The power of this tool and all the others must be taken into consideration when a vault is designed.

Telltale switchboard in the watch captain's room of the U. S. Treasury at Washington, D. C., which indicates operation of doors, time locks, and so on

When it was first realized what the cutter-burner and rod would do to metals, many vault engineers turned their backs abruptly on everything but reinforced concrete as a proper material for vaults. Consequently some vaults were built in which this material alone was relied on, walls of extraordinary thickness being laid in the hope that they would foil the burglar or hold him in check for days. Here, again, a considerable blunder was made, for, while reinforced concrete does give a maximum resistance to the torch, it is comparatively frail in the face of explosives and the high power tools which the highest type of burglar might command under special circumstances. All this was brought out by laboratory experiment and especially by a series of tests made under the auspices of the Federal government at its artillery proving grounds two or three years ago. All kinds of vault materials and constructions were there placed under every imaginable form of strain and subjected to all manner of attacks. It was hoped to develop a material or method of construction that would resist the worst buffetings for several days. I believe I am revealing no secret in saying that nothing of the sort was found and that the maximum period of resistance achieved was not more than a few hours.

According to Mr. Frederick S. Holmes, the celebrated New York bank engineer, the ideal vault of today is, like the great doors, just described, a composite. Its walls, floor and ceiling are constructed mainly of a special type of reinforced concrete, but many other materials figure in the structure. In the first place, the concrete is reinforced with such slight materials as woven cables and lengths of steel rails. Again, the concrete walls are full of anchors, facing both outward and inward, so that if burglars should succeed in cutting a plug out of one of these thick walls, they would be unable either to push the plug ahead of them into the vault or pull it out toward them. They would be forced to break it up into small chunks and thus gradually make an aperture large enough to admit them. In addition, the best wall, floor and ceiling construction of vaults now calls for both linings and interlinings of various metals, very much like those employed in the great doors.

To make his way through such a lined, interlined, reinforced and anchored wall of concrete, usually from two to three feet thick, the burglar would need, first of all, to break away the outer layers of concrete with tools and explosives. He would then encounter the metal interlining, which he would be forced to attack with the torch and rod. This done, he would again face great thicknesses of concrete, filled with reinforcing cables, rails and rods. Then he must again encounter a layer of various metals which would once more call for the torch. And, last but by no means least, he must have encountered the wires and cables of the alarm system before he had got well under way. The vault builder, however, builds independently of the alarm. He builds a wall capable of turning back a burglar even if the alarm does not function.

All this being understood, it must still be admitted that even vault walls of such monumental strength and intricate design might be breached in a few hours by burglars having the maximum of technical knowledge, the fullest equipment of the best tools, the best

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